CLAIMS

What is claimed is:

1. A programmable access point for interfacing a communications network with communications equipment located at user premises, said programmable access point comprising:

a line driver;

at least one sensing unit sensing the line driver load on said line driver; and

a processing unit comparing said sensed line driver load with at least one operating load limit, generating a line driver drive level in response to said comparison, said processing unit providing said line driver drive level to said line driver.

2. A programmable access point as in claim 1, said line driver driving a user communications line, user communications equipment connected to said user communications line, power being provided to said user communications equipment by said line driver over said user communications line, said line driver adjusting power provided to said user communications equipment in response to said line driver drive level.

3. A programmable access point as in claim 2, said processing unit decreasing said line driver drive level when said comparison indicates said sensed line driver load is less than a lower operating load limit and increasing said line driver drive level when said comparison indicates said sensed line driver load is greater than an upper operating load limit.

4. A programmable access point as in claim 3, said line driver providing a drive voltage controlled by said line driver drive level.

5. A programmable access point as in claim 4, wherein said sensing unit comprises a current sensor sensing a drive current on said user communications line, said drive voltage being adjusted in response to said sensed drive current.

6. A programmable access point as in claim 3, said line driver providing a drive current controlled by said line driver drive level.

7. A programmable access point as in claim 6 wherein said sensing unit comprises a voltage sensor sensing a line voltage on said user communications line, said drive current being adjusted in response to said sensed line voltage.

8. A programmable access point as in claim 6 wherein said sensing unit senses a line dc voltage component, said drive current being adjusted in response to said sensed line dc voltage component.

9. A programmable access point as in claim 8, said sensing unit further comprising a current sensor.

10. A programmable access point as in claim 3, said programmable access point further comprising a communications interface interfacing a communications network with connected user communications equipment, said line driver receiving a communication signal from said communications interface and driving said user communications line in response to said communications signal.

11. A programmable access point as in claim 10, said programmable access point further comprising:

a main power supply;

a backup power supply; and

at least one power supply status signal indicating operating status of said main power supply and said backup power supply, said processing unit adjusting said line driver drive level responsive to said at least one power supply status signal.

12. A programmable access point as in claim 11, wherein said line driver drive level is set to a minimum operating level when said at least one power supply status signal indicates said main power supply is in a low power state.

13. A programmable access point as in claim 12, wherein said line driver drive level is set to a minimum operating level when said at least one power supply signal indicates said backup power supply is in a low capacity state.

14. A programmable access point as in claim 3, said programmable access point further comprising a storage unit, said storage unit storing at least one provisioned value, at least one default value, and said at least one operating load limit, said processing unit initializing said at least one operating load limit to a selected one of said at least one provisioned value and said at least one default value.

15. A communications network comprising:

a central network;

a plurality of access points connected to said central network; and

a plurality of user lines connecting user equipment to ones of said plurality of access points, said access points selectively passing communication signals between said central network and connected said user equipment, at least one access point providing power over a connected user line to said connected user equipment, monitoring user line load, and dynamically adjusting power provided to said connected user equipment in response to said monitored user line load.

16. A communications network as in claim 15, wherein said at least one access point comprises:

a user line driver providing power to said connected user equipment and driving said communication signals passed to said connected user equipment;

at least one sensing unit sensing said user line load; and

a processing unit determining whether said sensed user line load is within operating load limits, updating said line driver operating point responsive to said determination, and providing said updated line driver operating point to said user line driver.

17. A communications network as in claim 16, said processing unit decreasing said line driver operating point in response to said determination indicating that said user line load is less than said operating load limits.

18. A communications network as in claim 17, said processing unit increasing said line driver operating point in response to said determination indicating that said user line load is greater than said operating load limits.

19. A communications network as in claim 18, said communications network further comprising a storage unit, default values and provisional values being stored in said storage unit, said processing unit initializing said operating load limits to one of said provisional values or said default values.

20. A communications network as in claim 19, said user line driver providing a drive voltage controlled by said line driver operating point, wherein said user line driver adjusts power provided to said user equipment by adjusting said drive voltage.

21. A communications network as in claim 20, wherein said sensing unit includes a current sensor sensing a drive current on said user line, said drive voltage being adjusted in response to said sensed drive current.

22. A communications network as in claim 19, said user line driver providing a drive current controlled by said line driver operating point, wherein said user line driver adjusts power provided to said user equipment by adjusting said drive current.

23. A communications network as in claim 22, wherein said sensing unit includes a voltage sensor sensing a user line voltage.

24. A communications network as in claim 22, wherein said sensing unit includes a voltage sensor sensing a dc user line voltage component, said drive current being adjusted in response to said sensed dc user line voltage component.

25. A communications network as in claim 24, wherein said sensing unit further includes a current sensor.

26. A communications network as in claim 24, said processing unit decreasing said line driver operating point when said determination indicates said sensed dc user line voltage component is greater than operating voltage limits, said line driver operating point adjusting said dc user line voltage component.

27. A communications network as in claim 24, said processing unit increasing said line driver operating point when said determination indicates said sensed dc user line voltage component is less than operating voltage limits, said line driver operating point adjusting said dc user line voltage component.

28. A communications network as in claim 24, wherein the processor compares a present sensed dc user line voltage with a previous sensed dc user line voltage, load changes being identified by said comparison, said drive current being adjusted in response to an identified load change

29. A communications network as in claim 28, said processing unit decreasing said line driver drive when said comparison indicates said load has decreased.

30. A communications network as in claim 28, said processing unit increasing said line driver drive when said comparison indicates said load has increased.

31. A communications network as in claim 18, said at least one access point further comprising:

a main power supply supplying power to said user line driver;

a backup power supply supplying backup power to said user line driver; and

power supply status signals indicating operating status of said main power supply and said backup power supply, said processing unit adjusting said line driver operating point responsive to said power supply status signals.

32. A communications network as in claim 31, wherein said line driver operating point is set to a minimum operating level when said power supply status signals indicate said main power supply is in a low power condition.

33. A communications network as in claim 32, wherein said line driver operating point is set to a minimum operating level when said power supply signals indicate said backup power supply is in a low capacity state.

34. A communications network as in claim 18, wherein each said plurality of access points provides power to connected said user equipment over a connected one of said user lines, monitors said user line load on said connected user line, and dynamically adjusts power provided to connected user equipment in response to said monitored user line load.

35. A control method for adjusting power supplied by a line driver over a user line to attached user equipment, said method comprising the steps of:

a) initializing line driver drive values;

b) setting a line driver drive in response to said line driver drive values;

c) monitoring characteristics of the output of said line driver;

d) determining whether said monitored characteristics are within a predetermined operating range;

e) updating said line driver drive values when said determination indicates said monitored characteristics are not in said normal operating range; and

f) returning to step (b).

36. A control method as in claim 35, wherein the step (a) of initializing line driver drive values comprises the steps of:

i) determining if provisioned line driver drive values have been previously set; and

ii) setting set point values to said provisioned line driver drive values if said provisioned line driver values are determined to have been previously set and, otherwise, setting said set point values to default set point values, said set point values defining said normal operating range.

37. A control method as in claim 35, wherein after setting said line driver drive in step (b) said control method further comprises the steps of:

b1) checking power supply status to determine whether line driver power is in a normal power state;

b2) continuing to the step (c) of monitoring characteristics if line driver power supplied is determined to be in said normal power state; otherwise

b3) setting said line driver drive values to predetermined minimum operating values; and

b4) returning to the step (b);

whereby said line driver is set to a minimum power level sufficient to power one user equipment device until power supply status indicates a normal power state.

38. A control method as in claim 37, wherein said step (c) of monitoring characteristics comprises the steps of:

i) sensing the user line voltage on said user line; and

ii) extracting a dc component value from said sensed user line voltage, said dc component value being compared with set point values, said set point values defining an upper limit and a lower limit of said normal operating range.

39. A control method as in claim 38, wherein if said extracted dc component value is below said normal operating range, said line driver drive is increased in said step (e).

40. A control method as in claim 38, wherein if said extracted dc component value is above said normal operating range, said line driver drive values are decreased in said step (e).

41. A control method as in claim 38 wherein said step (c) of monitoring further comprises the step of:

iii) extracting a magnitude of a frequency component from said sensed user line voltage.

42. A control method as in claim 41, wherein the step (d) of determining comprises:

determining whether said frequency component magnitude is within a threshold magnitude range defined by set point values.

43. A control method as in claim 42, wherein when said extracted frequency component magnitude is below said threshold magnitude range, the step (e) of updating said line driver drive values includes increasing a frequency line driver drive value.

44. A control method as in claim 42, wherein when said extracted frequency component magnitude is above said threshold magnitude range, the step (e) of updating said line driver drive values includes decreasing a frequency line driver drive value.

45. A computer program product for controlling a line driver providing power to connected communications equipment, said computer program product comprising a computer usable medium having computer readable program code thereon, said computer readable program code comprising:

computer readable program code means for initializing line driver drive values;

computer readable program code means for setting a line driver drive in a line driver responsive to said line driver drive values;

computer readable program code means for measuring characteristics of the output of said line driver;

computer readable program code means for comparing said measured characteristics to set point values; and

computer readable program code means for updating said line driver drive values in response to said comparison.

46. A computer program product as in claim 45, said computer readable program code means for updating includes computer readable program code means for increasing said line driver drive values when said measured characteristics are less than said set point values.

47. A computer program product as in claim 45, said computer readable code means for updating includes computer readable program code means for decreasing said line driver drive values when said measured characteristics are greater than or equal to said set point values.

48. A computer program product as in claim 45, said computer program product further comprising:

computer readable program code means for determining when power supplied to said line driver is in an insufficient power state; and

computer readable program code means for setting said line driver drive values to predetermined minimum operating values when said determination indicates an insufficient power state.

49. A computer program product as in claim 45, said computer program product further comprising computer readable program code means for storing said line driver drive values in a storage unit.

50. A computer program product as in claim 45, said computer program product further comprising computer readable program code means for preventing said line driver drive values from being changed when a power feature variable indicates that efficient power supply operation is disabled.

51. A computer program product as in claim 45, wherein said computer readable program code means for measuring characteristics includes computer readable code means for extracting a dc voltage component value from said measured voltage.

52. A computer program product as in claim 51, wherein said computer readable program code means for comparing compares said extracted dc voltage component value with at least one of a lower set point value and an upper set point value, said computer readable code means for updating adjusting said line driver drive values responsive to said comparison.

53. A computer program product as in claim 52, wherein said computer readable program code means for updating includes:

computer readable code means for increasing said line driver drive values when said dc voltage component value is less than said lower set point value; and

computer readable code means for decreasing said line driver drive values when said dc voltage component value is greater than said upper set point value.

54. A computer program product as in claim 51, wherein said computer program product further includes computer readable dc voltage difference code means for comparing a current sensed dc voltage component value with a previous sensed dc voltage component value, load changes being identified by said comparison carried out by said computer readable dc voltage difference code means, said line driver drive values being adjusted in response to a dc voltage difference indicating a load change.

55. A computer program product as in claim 54, wherein said computer readable program code means for updating decreases said line driver drive values when said comparison carried out by said computer readable dc voltage difference code means indicates said load has decreased.

56. A computer program product as in claim 54, wherein said computer readable program code means for updating increases said line driver drive values when said comparison carried out by said computer readable dc voltage difference code means indicates said load has increased.

57. A programmable access point for interfacing a communications network with communications equipment located at user premises, said programmable access point comprising:

a line driver having a load output and a drive level control input;

at least one sensor having an input operably coupled to the load output of the line driver and an output to provide a line driver load signal; and

a processing unit including at least a comparator, the comparator having a first input coupled to the sensing unit line driver load signal output, a second input coupled to receive an operating load limit, and a drive level control output coupled to the line driver drive level control input.

58. A programmable access point as in claim 57, said line driver load output coupled to a user communications line, user communications equipment connected to said user communications line, said line driver load output adapted to provide power to said user communications equipment adjusted in response to said comparator drive level control output.

59. A programmable access point as in claim 58, said comparator drive level control output decreasing when said sensed unit line driver load signal output is less than a lower operating load limit and increasing when said sensed unit line driver load signal output is greater than an upper operating load limit.

60. A programmable access point as in claim 59, said line driver load output comprising a drive voltage.

61. A programmable access point as in claim 60, wherein said sensing unit comprises a current sensor, said sensing unit output adapted to provide a sensed drive current signal, said drive voltage operably adjusted in response to said sensed drive current signal.

62. A programmable access point as in claim 61, said line driver load output comprising a drive current operably controlled by said line driver drive level.

63. A programmable access point as in claim 62 wherein said sensing unit comprises a voltage sensor, said sensing unit output adapted to provide a sensed line voltage signal, said drive current operably adjusted in response to said sensed line voltage signal.

64. A programmable access point as in claim 63 wherein said sensing unit output is adapted to provide a sensed dc voltage component signal, said drive current being adjusted in response to said sensed dc voltage component signal.

65. A programmable access point as in claim 64, said sensing unit further comprising a current sensor.

66. A programmable access point as in claim 59 further comprising:

a communications unit having a network interface coupled to a communications network to receive a communications signal and an output coupled to a communications input of said line driver, said line driver load output adapted to drive said user communications line in response to said communications signal.

67. A programmable access point as in claim 66, said programmable access point further comprising:

a power supply having a power output coupled to a power input of said line driver, said power supply having a status signal output to indicate operating status of said power supply, said power supply status signal output coupled to a third input of said comparator, said line driver drive level operably adjusted responsive to said status signal output.

68. A programmable access point as in claim 67, wherein said line driver drive level is operably adjusted to a minimum operating level when said power supply status signal output indicates said power supply is in one of a low power state and a low capacity state..

69. A programmable access point as in claim 59 further comprising:

a storage unit having a read output to provide a selected one of a provisioned value and a default value, said storage unit read output coupled to a memory input of said processing unit, said processing unit having an output to provide said operating load limit, said processing unit output coupled to said comparator second input, said operating load limit operably initialized to said selected one of said provisioned value and said default value.